EPA/CPG Model Collaboration Meeting
September 25th 2012
Summary and Action Items (DRAFT)

Participants:

EPA: Ray Basso, Eugenia Naranjo, Stephanie Vaughn, Ed Garland, James Wands

CPG: Rob Law, Geoffrey Seibel, Han Winterwerp, Rooni Matthew, Rafael Cañizares, John Connolly, Peter Israelsson, Pete Oates, Tal Ijaz

TSI: Cliff Firstenberg, Pravi Shrestha

Note: Summary below follows the discussion order. The meeting ended after 2:30 p.m. The next meeting will be tentatively schedule to take place in about two months.

1. Introduction:

- At EPA's request, John Connolly explained the updated configuration and roles within the CPG modeling team. AQEA is taking a larger role as a result of the recent SPG to CPG change. AQEA has transitioned from being the SPG consultant to a CPG consultant with new responsibilities. In particular, AQEA has prime responsibility is the Contaminant Fate & Transport (CFT) model and provides oversight of the bioaccumulation model developed by Windward, while M&N/Deltares are responsible for the hydrodynamic (HD) and sediment transport (ST) models, with all the team members working in close collaboration.
- EPA requested more open communication between the EPA and CPG modeling teams on the development of the CFT model. John Connolly indicated that the lack of communication was due to the initial AQEA focus, which was on coming "up-to-speed" on the modeling. The CPG was using today's meeting to kick off greater collaboration.
- Ray Basso mentioned that his expectation for these collaboration meetings is to have the experts work together in a transparent and free-flowing environment in which expressed ideas and preliminary results are not viewed as firm positions or official views of the EPA or CPG teams.

2. CPG Progress:

- Sediment Transport Development Memorandum
  - Presentation Topics (R. Mathew):
    - The main topics in the memorandum submitted to EPA on January 9th, 2013 were presented.
  - CPG Main Comments:
    - Responding to questions from EPA, Han Winterwerp provided the following information:
      - The 2012-2011 bathymetry comparison indicated that the LPR filled in during this period, with twice the amount of accumulation than occurred during the 2008-20087 period, which was twice as long.
      - Although observations indicate that the LPR is in a quasi-equilibrium state, there are still some areas of the river that experience cycles of erosion and deposition.
    - The CPG will check how the distribution of settling velocities among the particle size classes computed to be in the water column compares to the measured distribution. The data from the particle distribution analysis will be evaluated when available.
    - The major change from the EPA's version of the ST model is the introduction of the fluff layer and transition layer. The transitional layer is assigned erosion properties based on calibration with the constraint that these properties are between those of the fluff layer and the sedflume surface layer.
    - The transitional layers do not have an effect under storm conditions.
    - The CPG does not expect significant changes in the LPR ST model after changes in the Newark Bay (NB) ST model. The area of focus and potential changes could be between RM 0.0 and 1.4
    - The ST model in NB generates small changes in the main channel with some accumulation in the port channels. The critical shear stress for erosion of the fluff layer will be adjusted during calibration.

  - The LPR ST model does not feed the computed changes in bathymetry back to the hydrodynamic model, but it accounts for these changes through a continuity correction.
  - Han Winterwerp clarified that the model cannot be expected to exactly reproduce the maps of erosion and deposition generated from the differencing of multi-beam bathymetric surveys. These maps are subject to data error and the model is a simplification of the complex river environment. Of particular note is that since the model cannot resolve the fine-scale hydrodynamic processes that are likely important to the dynamics of the cyclic areas, it is not possible to get an exact match to the bathymetric differences evident between multi-beam surveys. The model should reproduce the large-scale behavior and trends that are observed in the data.

- EPA Main Comments:
  - E. Garland indicated that he recalls some erosion in the NB channel from the CPG model results. The model will probably require changing the grain size distribution in NB that now defined using an average value, and also the erosion properties of the fluff layer.
  - E. Garland indicated that he will follow up with R. Mathew on a number of detailed questions and clarifications he requires to understand all the aspects of the memorandum and code submitted to EPA.

Next Steps:

  - Calibrate sediment transport in Newark Bay
  - Continue developing the CSM for ST in NB

- Action Item:
  - Check settling velocity description in the model and compared to data.
  - Develop plots of measured/calculated critical shear stress for erosion from LPR Sedflume experiments at different layers
  - Review composition of infill material in the LPR ST model

- Contaminant Fate and Transport Model Development Update
  - Presentation Topics (P. Israelsson):
    - The CPG team is working on addressing the issues raised in the NRRB comment document.
    - The EPA model shows a fast initial recovery, and very slow future recovery. Based on the CPG analysis of the sediment data, this pattern does not match the observed trends. The model should not be recovering in erosional areas and the accelerated recovery in depositional areas is exaggerated.
    - Based on surface concentrations of 2,3,7,8 TCDD and historical deposition, the LPR has identified 4 different data "groups" in the LPR. Additionally, Group 3 areas, characterized by high surface concentration and low-to-moderate historical deposition, have been divided into two sub-groups based on the bathymetric differences between 1995 and 2012. These groupings form the basis of CPG's present approach to generating continuous surface concentration maps from the point measurements.
    - The CPG divided the river into three sediment transport regimes based on the CPG sediment transport model results: net erosional, mildly depositional and highly depositional. A predicted sedimentation of 15 cm during the 1995 to 2010 simulation (1 cm/year) was selected as the cut-off value to delineate the two depositional regimes.
    - The temporal trend in mean sediment concentrations was evaluated between RM1 and RM7 using contaminant data from 1995 to 1999 and 2008 to 2012 together with the CPG's surface mapping approach. The analysis indicates:
      - Net erosional areas are on average not recovering; mean concentrations have increased.
      - Mean concentrations in mildly depositional areas have not changed substantially.
      - Concentrations in highly depositional areas have declined.
    - A targeted remedy of areas that are not recovering should accelerate the recovery in areas that are recovering.

- Model diagnostics indicate that the predicted behavior of erosional areas is controlled by tidal pumping, whereas burial controls the depositional areas.
- Analysis of the CWCM data suggests that the mean LPR water column 2,3,7,8-TCDD concentration are about 5 to 15 % of the mean concentration observed in the top 15 cm of the bed (on a mass contaminant per mass of solids basis, under the presumption of a negligible dissolved fraction in CWCM data).
- Based on that finding, the concentration on sediments eroded during flood and ebb tide are not well-represented by the surface sediment (top 15 cm) 2,3,7,8-TCDD concentrations. While this may partially reflect a concentration gradient over the top 15 cm or dilution by less contaminated boundary solids, it is likely an indication that the intra-tidal erosion signal is associated with there being lower 2,3,7,8-TCDD concentrations in the fluff layer that accounts for most of the eroded sediment during low-to-moderate freshwater flow conditions.
- The CPG proposes to have a CFT framework that simulates a fluff layer.. The addition of a fluff layer within the CFT model is conceptually consistent with the inclusion of a fluff layer in the CPG ST model.
- Another key process affecting contaminant fate is desorption of contaminants associated with resuspended sediments. Unrealistic instantaneous transfer ("pumping") of contaminant from sediments with higher settling velocity to sediments with lower settling velocity could contribute to the rapid depletion of the surface sediment concentrations. Information on the boundary class distribution and high volume CWCM data will likely be useful in investigating this issue further.

- EPA Main Comments:
  - Are the Group 3 areas associated with the target remedy areas the CPG is identifying? Have these areas filled in?
  - What is the percentage in area of the target remedy under consideration?
  - Ed Garland asked how the data scarcity and interpolation techniques are influencing the analysis, and if any tests among the different data sets could be

done to validate the approach.

- Are the projections from a simulation using the CPG ST model and the EPA CFT model different from those presented by EPA?
- There are big differences in water column concentrations from the CWCM between surveys and times of the tide when they were measured.
- Is the water column concentration in equilibrium with the bed at each location of the river?
- EPA posited that the fluff layer framework might be implementable without code modification by changing thickness of surface layer and modify mixing coefficients
- EPA has tested the use of the model to develop concentration gradients in the bed surface layers, and it did not substantially change the answer in their case. However, EPA posited that CPG's model diagnostic analysis on dominant recovery mechanisms might be impacted by introducing an initial concentration gradient within the parent bed.
- E. Garland noted that it would be helpful to refine terminology to help distinguish among the various ST and CFT processes that are presently lumped together under the heading of "tidal pumping".

- CPG Main Comments:
  - The CPG has initially targeted about 15% of the river in its Targeted Remedy.
  - The CPG has used the grouping analysis and Thiessen polygons to develop the bed surface concentrations in the LPR. Using different data sets to validate the approach is not possible since normally they do not have a lot of overlap. Thiessen polygons seem to be the best approach in combination with the grouping analysis that uses the information on bathymetric differences.
  - The CPG has not yet evaluated projection simulations combining the CPG ST model with the EPA CFT model.
  - The CPG is not trying to draw conclusions beyond that there is a relation between the particulate concentration in the water column and the bed, and this relation in the order of what it was previously mentioned.

- Action Items:
  - The CPG will investigate the impact of applying a concentration gradient over the top 15 cm to the model initial conditions on its diagnostic analyses of model behavior.
  - The CPG will provide to EPA maps showing the polygons used to define the SWAC, including a description of the methodology.

- Status of Simplified Organic Carbon Model
  - Presentation Topics:
    - Feedback from EPA as part of documentation of September 2012 Collaboration Meeting minutes: "the algal portion of the organic carbon model could be eliminated and the simplified approach recommended by the CPG used"
    - The remediation module from ST-SWEM has been incorporated into the OC simplification approach.
      - OC release associated with dredging per remediation schedule
      - Post-remediation bed organic carbon fraction (f_{oc}) based on ST-SWEM initial conditions, and temporally constant.
  - EPA Main Comments:
    - EPA suggested that the carbon binding efficiencies could perhaps be used to address CPG's concern of unrealistic transfer of contaminant mass between slowly and rapidly settling particles in the CFT simulations.
  - CPG Main Comments:
    - Sensitivity to the post-remediation bed f_{oc} approach will be evaluated, to understand its implication and if a new approach is needed.
    - It seems doubtful that differential carbon binding efficiencies can be used to address CPG's concern about artificial contaminant mass transfer within the water column, because clays and silts are not distinguished within ST-SWEM or the OC simplification code.

- Action Items:
    - CPG to provide EPA with the code and the linkage file for the latest version of the simplified OC model.
    - CPG to consider whether carbon binding efficiencies can be useful in controlling artificial mass transfer among suspended solids within CFT model simulations.

3. Newark Bay Sedflume Data Collection Status

- Presentation Topics (E. Naranjo):
    - Completed all Field and Consolidation Lab cores
    - Test completed: PSD, Dry Bulk density, LOI, Atterberg limits,
    - Consolidation core data will be available the week of 3/8
    - Raw data will be provided next week.
- Action Items:
    - EPA will provide data to the CPG as available
    - A meeting should be organized to discuss the results after the data are available to all the parties.

4. Newark Bay Sediment Transport System Understanding

- Presentation Topics (H. Winterwerp):
  - NB channel could be a source of sediments if the bed is swelling as a consequence of the channel deepening. No data are available to confirm this.
  - NB sediment dynamics do not appear to have long term memory. High historical sedimentation in the Bay is limited to particular areas, mainly abandoned channels.
  - More detailed evaluation of Shooters Island and Arthur Kill will be attempted within the future work.
  - The CPG team is assessing travel times and exchange among regions using the existing numerical model.
  - There is a phase difference in the tide and flows between the Hackensack and the Passaic rivers. The exact exchange between these two water bodies is not known. The CPG is trying to evaluate the importance of the exchange using the model.
- CPG Main comments:
  - 2012 multibeam bathymetry indicates the same behavior observed from the previously presented analysis: after a flow event sediment accumulates in the lower miles and northern NB, and then migrates back up the LPR during low flow conditions. The fraction of the LPR sediment load that is accumulated during high flow events in this manner is not known.
  - The multi-beam bathymetry is not complete so it cannot tell the whole story because of the cross channel extent.
  - Waves are possibly the process that maintains the stability of the shoals, with the material that deposits on those regions being easily resuspended by the waves, while the existing bed being very stable even at high shear stresses
  - Shipping could be an important factor in reducing deposition in the channels. In particular it could be an important element for sediment resuspension in the lower miles of the LPR.

- EPA Main comments:
    - EPA asked about the status of the 2012 bathymetry analysis in conjunction with the bathymetric analysis work.
- TSI Main comments:
    - Shipping in northwestern NB and the lower LPR is fairly limited relative to further south in NB, so its importance may also be limited.

5. Newark Bay Bathymetric Survey Update
    - Presentation Topics (C. Firstenberg):
        - OSI is carrying out the survey with EPA oversight.
        - It is a combination of multi and single beam measurements.
        - Data and report will be available in April 2013.
        - Single beam surveys were done to a depth of 3 ft MLW; the original goal of a 2 ft depth was changed following operational challenges.
        - Multi beam was done to a depth of 8 ft MLW (originally 6 ft).
        - Multi beam angle was used at +- 60 degrees. Sensitivity to this change from 45 degrees was tested.
    - CPG Main Comments:
        - What is the frequency of the single and multi beam surveys?
6. Other topics
    - EPA FFS Modeling
        - The major update discussed was the EPA's efforts to refine projections to include more detailed representation of bathymetric changes during dredging, by simulating full feedback between the HD and ST simulations.
        - EPA is preparing to transmit all FFS remediation scenario inputs to the CPG, as requested.